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(54) FLOW MODULATOR FOR A FLUID

DURCHFLUSSMODULATOR FÜR EIN FLUID

MODULATEUR D'ÉCOULEMENT D'UN FLUIDE

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EP-A1- 3 792 531 GB-A- 2 200 715
US-A1- 2011 180 737

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Description

[0001] The invention relates to a flow modulator for a fluid like combustion gas.

[0002] DE 40 30 717 A1 discloses a flow modulator for a fluid having a housing and a valve body. The valve body is provided by a foil element. The foil element has an opening for the fluid. The foil element is carried by a driver. The driver and the foil element are both positioned within a chamber of the housing. The driver and the foil element are both linear displaceable within the chamber of the housing thereby changing an overlap between an opening of the housing and the opening of the foil element.

[0003] EP 3 792 531 A1 discloses another flow modulator for a fluid comprising a housing, a modulator body, and a valve body. The modulator body has a flow channel and an opening providing together a flow passage for the fluid. The valve body is provided by a foil element. The foil element has an opening for the fluid. The foil element is rotatable relative to the modulator body to modulate the flow of the fluid by adjusting an overlap between the opening of the valve body and the flow passage of the modulator body.

[0004] US 2011 / 0 180 737 A1 discloses a flow modulator according to the preamble of claim 1.

[0005] Against this background, a novel flow modulator for a fluid like combustion gas is provided.

[0006] The novel flow modulator for a fluid like combustion gas according to the present disclosure comprises a modulator body having a channel providing a flow passage for the fluid.

[0007] The novel flow modulator further comprises a valve body having an opening providing another flow passage for the fluid.

[0008] The novel flow modulator further comprises an actuator by which the valve body is rotatably displaceable relative to the modulator body to modulate the fluid flow by changing the overlap between the opening of the valve body and the channel of the modulator body.

[0009] The novel flow modulator further comprises a gear transmission, wherein an input side of the gear transmission is in operative connection with the actuator having a fixed axis of rotation, and wherein an output side of the gear transmission is in operative connection with the valve body having a translationally displaceable axis of rotation.

[0010] The novel flow modulator provides a reliable flow modulation of the fluid. The gear transmission of the flow modulator allows for a tolerance-compensation within the flow modulator, namely to compensate component tolerance of the flow modulator. Simple and inexpensive assembly of the flow modulator is possible. A large resolution of flow resistance is made possible by a respective transmission ratio of the gear transmission.

[0011] The valve body has a guide pin being positioned in the axis of rotation of the valve body, and the modulator body has a guide groove for the guide pin of the valve

body, wherein the guide groove is configured to allow a rotational displacement of the valve body relative to the modulator body, is further configured to allow a translational displacement of the valve body relative to the modulator body in a distance direction of the axis of rotation of the actuator and the axis of rotation of the valve body, and is further configured to prevent a translational displacement of the valve body relative to the modulator body diagonal and/or orthogonal to said distance direction of the axis of rotation of the actuator and the axis of rotation of the valve body. The allows for a very favorable tolerance-compensation within the flow modulator.

[0012] Preferably, the the gear transmission comprises a first toothing provided by a drive wheel, the gear transmission comprises a second toothing provided by the valve body, wherein the first toothing is in operative connection with the second toothing. Preferably, the valve body has a circumferential groove, wherein the drive wheel is at least partially positioned within said circumferential groove, and wherein the circumferential groove has radial width being configured to allow rotation of the valve body relative to the modulator body around the axis of rotation of the valve body while keeping the first toothing of the drive wheel always in operative connection with the second toothing of the valve body. This allows a favorable tolerance-compensation within the flow modulator while providing a simple and inexpensive assembly of the flow modulator.

[0013] The first toothing may be provided by a section of the drive wheel that is at least partially positioned within said circumferential groove, while the second toothing is provided by a wall of the circumferential groove. Alternatively, the first toothing is provided by a section of the drive wheel that is positioned outside of said circumferential groove, while the second toothing is provided by a wall of the valve body.

[0014] Preferred developments of the invention are provided by the dependent claims and the description of the drawings. Exemplary embodiments are explained in more detail on the basis of the drawing, in which:

- Figure 1a shows a cross section of a flow modulator according to a first embodiment of the invention;
- Figure 1b shows another cross section of a flow modulator according to the first embodiment of the invention;
- Figure 1c shows another cross section of a flow modulator according to the first embodiment of the invention;
- Figure 1d shows a perspective view of a detail of the flow modulator of Figure 1a to 1c;
- Figure 2a shows a cross section of a flow modulator according to a second embodiment of the invention;
- Figure 2b shows another cross section of a flow modulator according to the second embodiment of the invention;

- Figure 3a shows a cross section of a flow modulator according to a third embodiment of the invention;
- Figure 3b shows another cross section of a flow modulator according to the third embodiment of the invention;
- Figure 4a shows a cross section of a flow modulator according to a fourth embodiment of the invention;
- Figure 4b shows another cross section of a flow modulator according to the fourth embodiment of the invention.

[0015] The present invention relates to a flow modulator 10 for a fluid, preferably for a gaseous fluid like combustion gas. The flow modulator 10 is preferably part of a gas burner appliance of a heating system. A flow modulator for a gaseous fluid can also be called gas flow modulator.

[0016] Figures 1a to 4b show different views of flow modulators 10 according to the invention. Identical reference signs are used for identical or similar parts.

[0017] The flow modulator 10 comprises a modulator body 11.

[0018] The modulator body 11 may be part of a housing 12. The housing 12, namely a side wall 12a of the housing 12, provides an opening 13 acting as inlet port for the fluid. The modulator body 11 may provide a bottom wall 12b of the housing 12.

[0019] The modulator body 11 has a channel 14 providing a flow passage 20 for the fluid. Said channel 14 or flow passage 20 is in communication with an opening 15 acting as outlet port for the fluid.

[0020] A top wall 12c of the housing 12 delimits together with the bottom wall 12b and the side walls 12a an interior space 16 of the housing 12.

[0021] It should be noted that the flow direction of the fluid may also be in the opposite way. In this case the opening 15 acts as inlet port for the fluid and the opening 13 acts as outlet port for the fluid.

[0022] The flow modulator 10 further comprises a valve body 17. The valve body 17 is positioned within the interior space 16 of the housing 12. The valve body 17 has an opening 18 providing another flow passage 19 for the fluid.

[0023] The flow modulator 10 further comprises an actuator 21. The actuator 21 may be an electrical motor like a stepper motor.

[0024] By use of the actuator 21 the valve body 17 is rotatably displaceable relative to the modulator body 11 to modulate the fluid flow. The fluid flow is modulated by changing the overlap between the opening 18 or flow passage 19 of the valve body 17 and the channel 14 of flow passage 20 of the modulator body 11.

[0025] The flow modulator 10 further comprises a gear transmission 22.

[0026] An input side of the gear transmission 22 is in operative connection with the actuator 21 having a fixed

axis of rotation 23.

[0027] An output side of the gear transmission 22 is in operative connection with the valve body 17 having a translationally displaceable axis of rotation 24.

[0028] The valve body 17 has a guide pin 25 being positioned in the axis of rotation 24 of the valve body 17. The modulator body 11 has a guide groove 26 for the guide pin 25 of the valve body 17.

[0029] The guide groove 26 is configured to allow a rotational displacement of the valve body 17 relative to the modulator body 11.

[0030] The guide groove 26 is further configured to allow a translational displacement of the valve body 17 relative to the modulator body 11 in a distance direction X of the axis of rotation 23 of the actuator 21 and the axis of rotation 24 of the valve body 17.

[0031] However, the guide groove 26 is further configured to prevent a translational displacement of the valve body 17 relative to the modulator body 11 diagonal and/or orthogonal to said distance direction X of the axis of rotation 23 of the actuator 11 and the axis of rotation 24 of the valve body 17.

[0032] The guide pin 25 of the valve body may be a cylinder. The guide groove 26 of modulator body 11 may be an oblong hole.

[0033] The dimension of the guide groove 26 in said distance direction X of the axis of rotation 23 of the actuator 21 and the axis of rotation 24 of the valve body 17 is larger than the diameter of the guide pin 25 thereby allowing the translational displacement of the valve body 17 relative to the modulator body 11 in said distance direction X.

[0034] The dimension of the guide groove 26 orthogonal to said distance direction X of the axis of rotation 23 of the actuator 21 and the axis of rotation 24 of the valve body 17 is adapted to the diameter of the guide pin 25 thereby preventing the translational displacement of the valve body 17 relative to the modulator body 11 diagonal and/or orthogonal to said distance direction X.

[0035] The gear transmission 22 comprises a first toothing 27 provided by a drive wheel 28. The drive wheel 28 provides or corresponds to the input side of the gear transmission 22.

[0036] The gear transmission 22 further comprises a second toothing 29 provided by the valve body 27. The valve body 27 provides or corresponds to the output side of the gear transmission 22.

[0037] The first toothing 27 is in operative connection with the second toothing 29. The first toothing 27 and the second toothing 29 comb directly into each other thereby providing a single-stage transmission. However, by using at least one further toothing between the first toothing 27 and the second toothing 29 a multi-stage transmission may be provided.

[0038] The valve body 27 has a circumferential groove 30. The drive wheel 28 connected to the axis of rotation 23 of the actuator 21 is at least partially positioned within said circumferential groove 30.

[0039] The circumferential groove 30 has radial width being configured to allow rotation of the valve body 17 relative to the modulator body 11 around the axis of rotation 24 of the valve body 17 while keeping the first toothing 27 of the drive wheel 28 always in operative connection with the second toothing 29 of the valve body 17.

[0040] In the embodiment of Figures 1a to 1d, the first toothing 27 is provided by a section of the drive wheel 28 that is at least partially positioned within said circumferential groove 30, while the second toothing 29 is provided a wall of the circumferential groove 30, namely by a radial outer wall 30a of the circumferential groove 30.

[0041] In the embodiment of Figures 2a and 2b, the first toothing 27 is provided by a section of the drive wheel 28 that is at least partially positioned within said circumferential groove 30, while the second toothing 29 is provided a wall of the circumferential groove 30, namely by a radial inner wall 30b of the circumferential groove 30.

[0042] In the embodiment of Figures 3a and 3b, the first toothing 27 is provided by a section of the drive wheel 28 that is at positioned outside of said circumferential groove 30, while the second toothing 29 is provided by a wall 31 of the valve body 17, namely as an internal toothing of said wall 31.

[0043] In the embodiment of Figures 4a and 4b, the first toothing 27 is provided by a section of the drive wheel 28 that is at positioned outside of said circumferential groove 30, while the second toothing 29 is provided by a wall 31 of the valve body 17, namely as an external toothing of said wall 31.

[0044] The embodiments of Figures 1a to 4b differ from each other by the technical design of the first toothing 27 and the second toothing 29.

[0045] In the embodiment of Figures 1a to 1d and in the embodiment of Figures 2a and 2b the first toothing 27 is provided by a section of the drive wheel 28 that is at least partially positioned within said circumferential groove 30 and the second toothing 29 is provided by a wall of the circumferential groove 30. The opposite wall of the groove 30 does not have a toothing and is smooth. In the embodiment of Figures 3a and 3b and in the embodiment of Figures 4a and 4b the first toothing 27 is provided by a section of the drive wheel 28 that is positioned outside said circumferential groove 30 and the second toothing 29 is provided a wall 31 of the valve body 17. In these embodiments both opposite walls of the groove 30 are smooth.

[0046] Nevertheless, in all embodiments the groove 30 of the valve body 17 has radial width being configured to allow the rotation of the valve body 17 relative to the modulator body 11 around the axis of rotation 24 of the valve body 17 while keeping the first toothing 27 of the drive wheel 28 always in operative connection with the second toothing 29 of the valve body 17. The drive wheel 28 bears against a respective wall of the groove 30 depending on the position and/or displacement of the valve body 17.

[0047] The circumferential groove 30 has radial width

being configured to provide a radial play between the drive wheel 28 and the valve body 17 allowing the rotation of the valve body 17 relative to the modulator body 11 around the axis of rotation 24 of the valve body 17 while keeping the first toothing 27 of the drive wheel 28 always in operative connection with the second toothing 29 of the valve body 17.

[0048] The translational displacement of the valve body 17 is provided by the interaction of the guide pin 25 of the valve body 17 with the guide groove 26 of the modulator body and by the interaction of the circumferential groove 30 of the valve body 17 with the drive wheel 28.

List of reference signs

[0049]

10	flow modulator
11	modulator body
12	housing
12a	side wall
12b	bottom wall
12c	top wall
13	opening
14	channel
15	opening
16	interior space
17	valve body
18	opening
19	flow passage
20	flow passage
21	actuator
22	gear transmission
23	axis of rotation
24	axis of rotation
25	guide pin
26	guide groove
27	first toothing
28	drive wheel
29	second toothing
30	groove
30a	radial outer wall
30b	radial inner wall
31	wall

Claims

1. Flow modulator (10) for a fluid like combustion gas, comprising:

a modulator body (11) having a channel (14) providing a flow passage (20) for the fluid;
a valve body (17) having an opening (18) providing another flow passage (19) for the fluid;
an actuator (21) by which the valve body (17) is rotatably displaceable relative to the modulator body (11) to modulate the fluid flow by changing

the overlap between the opening (18) or flow passage (19) of the valve body (17) and the channel (14) or flow passage (20) of the modulator body (11);

a gear transmission (22),

wherein an input side of the gear transmission (22) is in operative connection with the actuator (21) having a fixed axis of rotation (23),

wherein

an output side of the gear transmission (22) is in operative connection with the valve body (17) having a translationally displaceable axis of rotation (24),

and wherein the valve body (17) has a guide pin (25) being positioned in the axis of rotation (24) of the valve body (17), **characterised in that** the modulator body (11) has a guide groove (26) for the guide pin (15) of the valve body (17), wherein the guide groove (26) is configured to

allow a rotational displacement of the valve body (17) relative to the modulator body (11),

allow a translational displacement of the valve body (17) relative to the modulator body (11) in a distance direction (X) of the axis of rotation (23) of the actuator (21) and the axis of rotation (24) of the valve body (17),

prevent a translational displacement of the valve body (17) relative to the modulator body (11) diagonal and/or orthogonal to said distance direction (X) of the axis of rotation (23) of the actuator (21) and the axis of rotation (24) of the valve body (17).

2. Flow modulator as claimed in claim 1, characterized in that

the guide pin (25) of the valve body (17) is a cylinder,
the guide groove (26) of modulator body (11) is an oblong hole.

3. Flow modulator as claimed in claim 1 or 2, characterized in that

the gear transmission (22) comprises a first toothing (27) provided by a drive wheel (28),
the gear transmission (22) comprises a second toothing (29) provided by the valve body (17),
the first toothing (27) is in operative connection with the second toothing (29).

4. Flow modulator as claimed in claim 3, characterized in that

the valve body (17) has a circumferential groove

(30),

the drive wheel (18) is at least partially positioned within said circumferential groove (30),
the circumferential groove (30) has radial width being configured to allow rotation of the valve body (17) around the axis of rotation of the valve body (17) while keeping the first toothing (27) of the drive wheel (28) always in operative connection with the second toothing (29) of the valve body (17).

5. Flow modulator as claimed in claim 4, characterized in that

the first toothing (27) is provided by a section of the drive wheel (28) that is at least partially positioned within said circumferential groove (30),
the second toothing (29) is provided by a wall of the circumferential groove (30).

6. Flow modulator as claimed in claim 5, characterized in that

the second toothing (29) is provided by a radial inner wall (30b) of the circumferential groove (30).

7. Flow modulator as claimed in claim 5, characterized in that

the second toothing (29) is provided by a radial outer wall (30a) of the circumferential groove (30).

8. Flow modulator as claimed in claim 4, characterized in that

the first toothing (27) is provided by a section of the drive wheel (28) that is at positioned outside of said circumferential groove (30),
the second toothing (29) is provided by a wall (31) of the valve body (17).

9. Flow modulator as claimed in claim 8, characterized in that

the second toothing (29) is provided as an internal toothing.

10. Flow modulator as claimed in claim 8, characterized in that

the second toothing (29) is provided as an external toothing.

Patentansprüche

1. Durchflussmodulator (10) für ein Fluid wie Verbrennungsgas, Folgendes aufweisend:

einen Modulatorkörper (11) mit einem Kanal (14), der einen Strömungsdurchgang (20) für das Fluid vorsieht;

einen Ventilkörper (17) mit einer Öffnung (18), die einen weiteren Strömungsdurchgang (19) für das Fluid vorsieht;

ein Stellglied (21), über welches der Ventilkörper (17) in Bezug zum Modulatorkörper (11) in Drehrichtung verlagerbar ist, um die Fluidströmung zu modulieren, indem die Überlagerung zwischen der Öffnung (18) oder dem Strömungsdurchgang (19) des Ventilkörpers (17) und dem Kanal (14) oder Strömungsdurchgang (20) des Modulatorkörpers (11) verändert wird; ein Getriebe (22), wobei eine Eingangsseite des Getriebes (22) mit dem Stellglied (21), das eine feste Drehachse (23) aufweist, wirkverbunden ist, wobei eine Ausgangsseite des Getriebes (22) mit dem Ventilkörper (17), der eine linear verlagerbare Drehachse (24) aufweist, wirkverbunden ist, und wobei der Ventilkörper (17) einen Führungsstift (25) aufweist, der in der Drehachse (24) des Ventilkörpers (17) positioniert ist, **dadurch gekennzeichnet, dass**

der Modulatorkörper (11) eine Führungsnut (26) für den Führungsstift (25) des Ventilkörpers (17) aufweist, wobei die Führungsnut (26) dazu ausgestaltet ist,

eine Verlagerung des Ventilkörpers (17) in Drehrichtung in Bezug zum Modulatorkörper (11) zuzulassen,

eine lineare Verlagerung des Ventilkörpers (17) in Bezug zum Modulatorkörper (11) in einer Entfernungsrichtung (X) der Drehachse (23) des Stellglieds (21) und der Drehachse (24) des Ventilkörpers (17) zuzulassen,

eine lineare Verlagerung des Ventilkörpers (17) in Bezug zum Modulatorkörper (11) diagonal und/oder senkrecht zu der Entfernungsrichtung (X) der Drehachse (23) des Stellglieds (21) und der Drehachse (24) des Ventilkörpers (17) zu verhindern.

2. Durchflussmodulator nach Anspruch 1, dadurch gekennzeichnet, dass

der Führungsstift (25) des Ventilkörpers (17) ein Zylinder ist, die Führungsnut (26) des Modulatorkörpers (11) eine längliche Bohrung ist.

3. Durchflussmodulator nach Anspruch 1 oder 2, dadurch gekennzeichnet, dass

das Getriebe (22) eine erste Verzahnung (27) aufweist, die durch ein Antriebsrad (28) vorgesehen ist, das Getriebe (22) eine zweite Verzahnung (29) aufweist, die durch den Ventilkörper (17) vorge-

sehen ist, die erste Verzahnung (27) mit der zweiten Verzahnung (29) wirkverbunden ist.

4. Durchflussmodulator nach Anspruch 3, dadurch gekennzeichnet, dass

der Ventilkörper (17) eine Umfangsnut (30) aufweist, das Antriebsrad (18) zumindest teilweise innerhalb der Umfangsnut (30) positioniert ist, die Umfangsnut (30) eine radiale Breite aufweist, die dazu ausgestaltet ist, die Drehung des Ventilkörpers (17) um die Drehachse des Ventilkörpers (17) zuzulassen, während die erste Verzahnung (27) des Antriebsrads (28) stets mit der zweiten Verzahnung (29) des Ventilkörpers (17) wirkverbunden bleibt.

5. Durchflussmodulator nach Anspruch 4, dadurch gekennzeichnet, dass

die erste Verzahnung (27) durch einen Abschnitt des Antriebsrads (28) vorgesehen ist, der zumindest teilweise innerhalb der Umfangsnut (30) positioniert ist, die zweite Verzahnung (29) durch eine Wand der Umfangsnut (30) vorgesehen ist.

6. Durchflussmodulator nach Anspruch 5, dadurch gekennzeichnet, dass

die zweite Verzahnung (29) durch eine radiale Innenwand (30b) der Umfangsnut (30) vorgesehen ist.

7. Durchflussmodulator nach Anspruch 5, dadurch gekennzeichnet, dass

die zweite Verzahnung (29) durch eine radiale Außenwand (30a) der Umfangsnut (30) vorgesehen ist.

8. Durchflussmodulator nach Anspruch 4, dadurch gekennzeichnet, dass

die erste Verzahnung (27) durch einen Abschnitt des Antriebsrads (28) vorgesehen ist, der außerhalb der Umfangsnut (30) positioniert ist, die zweite Verzahnung (29) durch eine Wand (31) des Ventilkörpers (17) vorgesehen ist.

9. Durchflussmodulator nach Anspruch 8, dadurch gekennzeichnet, dass

die zweite Verzahnung (29) als Innenverzahnung vorgesehen ist.

10. Durchflussmodulator nach Anspruch 8, dadurch gekennzeichnet, dass

die zweite Verzahnung (29) als Außenverzahnung vorgesehen ist.

Revendications

1. Modulateur d'écoulement (10) d'un fluide tel qu'un gaz de combustion, comprenant :

un corps de modulateur (11) comportant un canal (14) fournissant un passage d'écoulement (20) pour le fluide ;

un corps de soupape (17) comportant une ouverture (18) fournissant un autre passage d'écoulement (19) pour le fluide ;

un actionneur (21) par lequel le corps de soupape (17) peut être déplacé en rotation par rapport au corps de modulateur (11) pour moduler l'écoulement de fluide en modifiant le chevauchement entre l'ouverture (18) ou le passage d'écoulement (19) du corps de soupape (17) et le canal (14) ou le passage d'écoulement (20) du corps de modulateur (11) ;

une transmission par engrenages (22), un côté entrée de la transmission par engrenages (22) étant en liaison opérationnelle avec l'actionneur (21) comportant un axe de rotation fixe (23),

un côté sortie de la transmission par engrenages (22) étant en liaison opérationnelle avec le corps de soupape (17) comportant un axe de rotation mobile en translation (24),

et le corps de soupape (17) comporte un axe de guidage (25) positionné dans l'axe de rotation (24) du corps de soupape (17), **caractérisé en ce que**

le corps de modulateur (11) comporte une rainure de guidage (26) pour l'axe de guidage (25) du corps de soupape (17), la rainure de guidage (26) étant conçue pour permettre un déplacement en rotation du corps de soupape (17) par rapport au corps de modulateur (11),

permettre un déplacement en translation du corps de soupape (17) par rapport au corps de modulateur (11) dans une direction de distance (X) de l'axe de rotation (23) de l'actionneur (21) et de l'axe de rotation (24) du corps de soupape (17),

empêcher un déplacement en translation du corps de soupape (17) par rapport au corps de modulateur (11) diagonal et/ou orthogonal à ladite direction de distance (X) de l'axe de rotation (23) de l'actionneur (21) et de l'axe de rotation (24) du corps de soupape (17).

2. Modulateur d'écoulement selon la revendication 1, **caractérisé en ce que**

l'axe de guidage (25) du corps de soupape (17) est un cylindre,
la rainure de guidage (26) du corps de modula-

teur (11) étant un trou oblong.

3. Modulateur d'écoulement selon la revendication 1 ou 2, **caractérisé en ce que**

la transmission par engrenages (22) comprenant une première denture (27) fournie par une roue motrice (28),

la transmission par engrenages (22) comprenant une seconde denture (29) fournie par le corps de soupape (17),

la première denture (27) étant en liaison opérationnelle avec la seconde denture (29).

4. Modulateur d'écoulement selon la revendication 3, **caractérisé en ce que**

le corps de soupape (17) comporte une rainure circonférentielle (30),

la roue motrice (18) est au moins partiellement positionnée dans ladite rainure circonférentielle (30),

la rainure circonférentielle (30) a une largeur radiale conçue pour permettre la rotation du corps de soupape (17) autour de l'axe de rotation du corps de soupape (17) tout en maintenant la première denture (27) de la roue motrice (28) toujours en liaison opérationnelle avec la seconde denture (29) du corps de soupape (17).

5. Modulateur d'écoulement selon la revendication 4, **caractérisé en ce que**

la première denture (27) est fournie par une section de la roue motrice (28) qui est au moins partiellement positionnée à l'intérieur de ladite rainure circonférentielle (30),

la seconde denture (29) est fournie par une paroi de la rainure circonférentielle (30).

6. Modulateur d'écoulement selon la revendication 5, **caractérisé en ce que**

la seconde denture (29) est fournie par une paroi intérieure radiale (30b) de la rainure circonférentielle (30) .

7. Modulateur d'écoulement selon la revendication 5, **caractérisé en ce que**

la seconde denture (29) est fournie par une paroi extérieure radiale (30a) de la rainure circonférentielle (30) .

8. Modulateur d'écoulement selon la revendication 4, **caractérisé en ce que**

la première denture (27) est fournie par une section de la roue motrice (28) qui est positionnée à l'extérieur de ladite rainure circonférentielle

(30),
la seconde denture (29) est fournie par une paroi
(31) du corps de soupape (17).

9. Modulateur d'écoulement selon la revendication 8, 5
caractérisé en ce que
la seconde denture (29) est fournie par une denture
interne.
10. Modulateur d'écoulement selon la revendication 8, 10
caractérisé en ce que
la seconde denture (29) est fournie comme une den-
ture externe.

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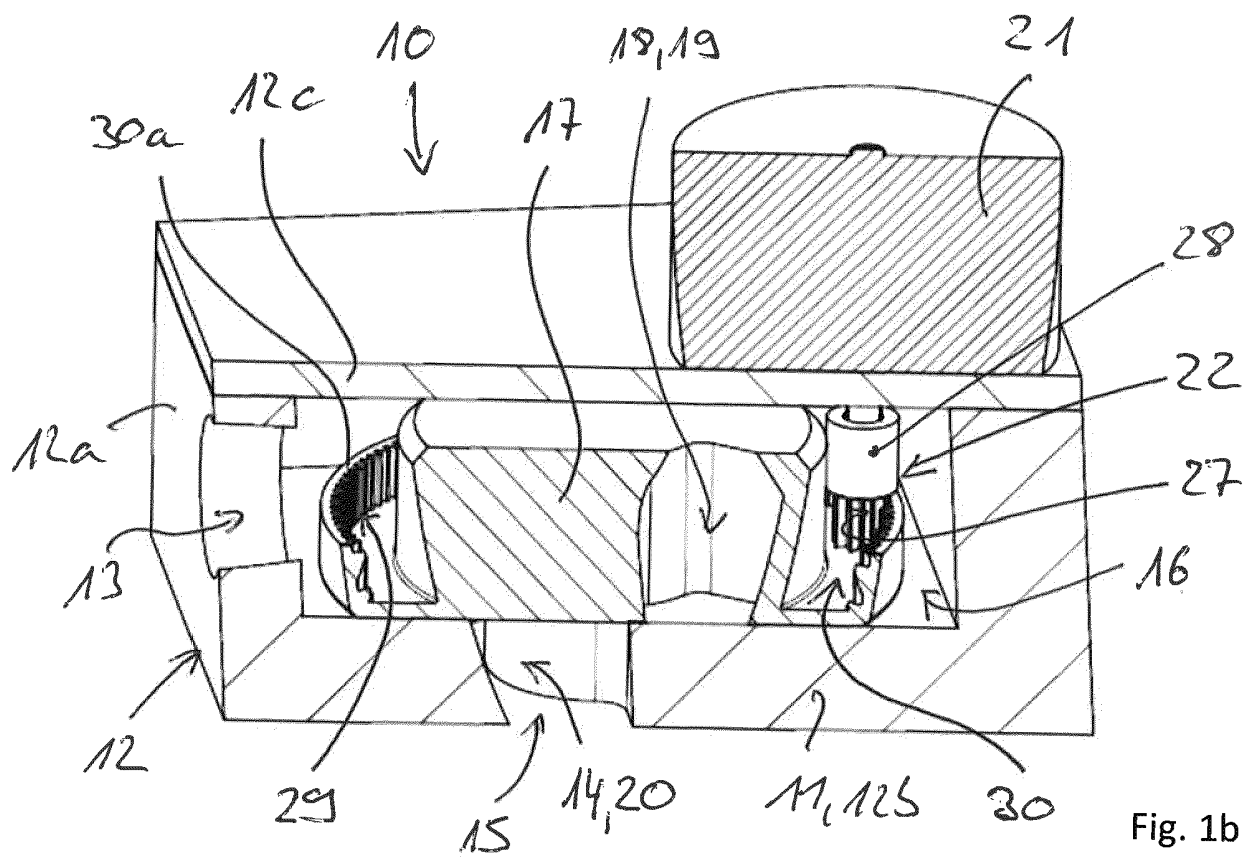
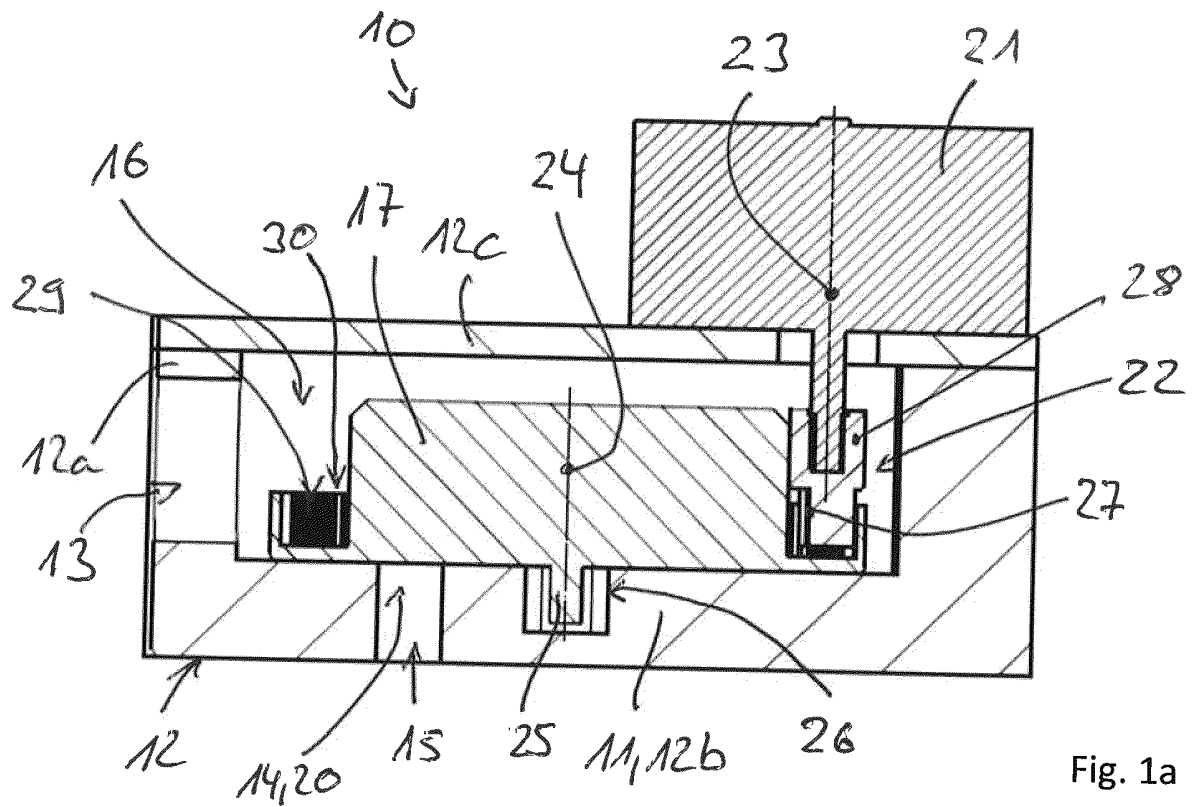
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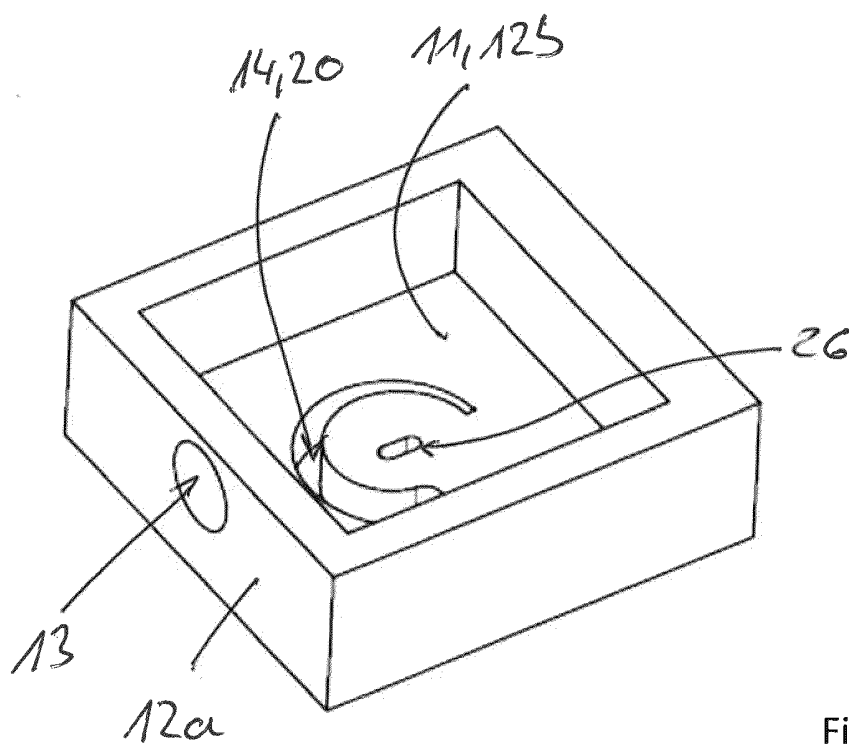
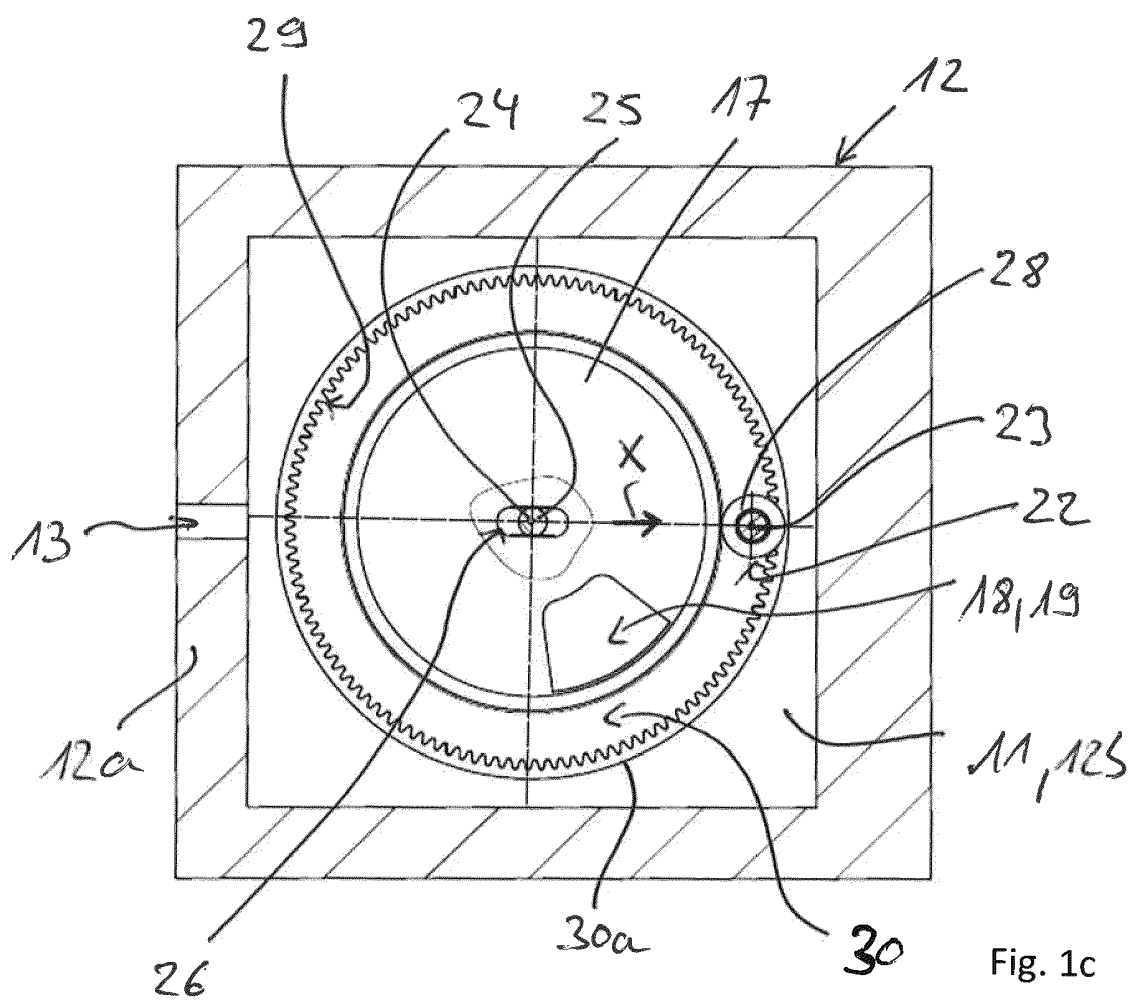
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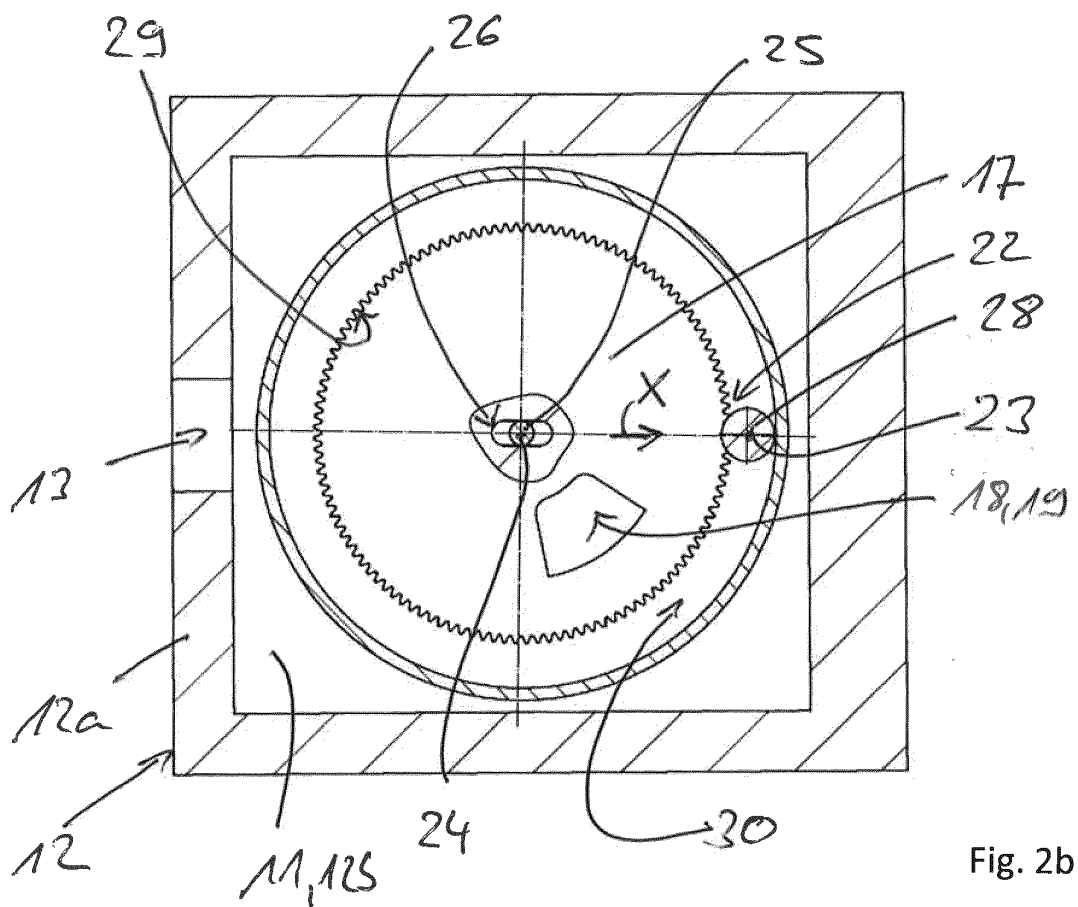
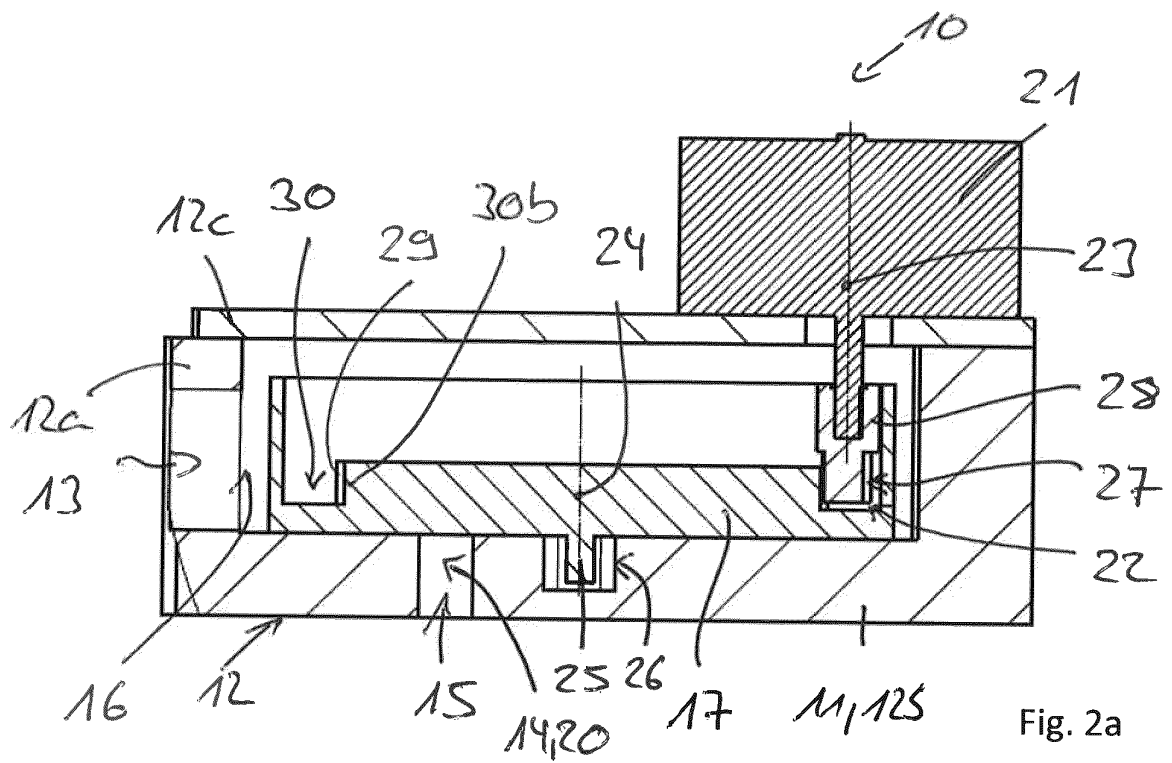
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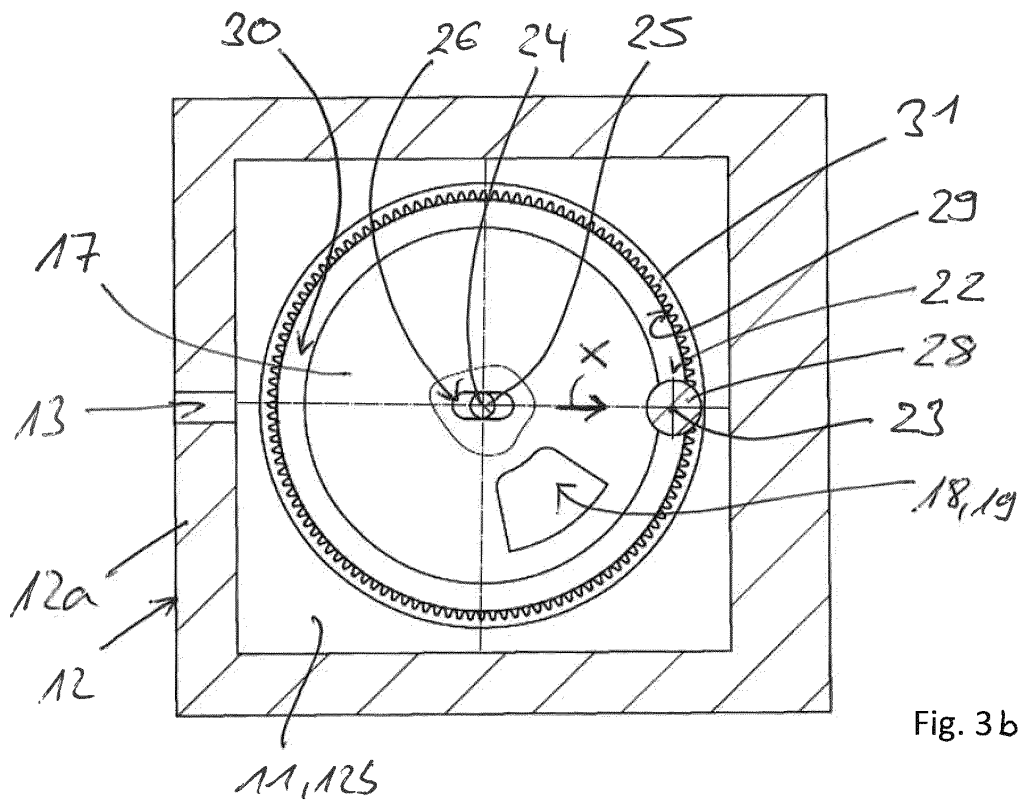
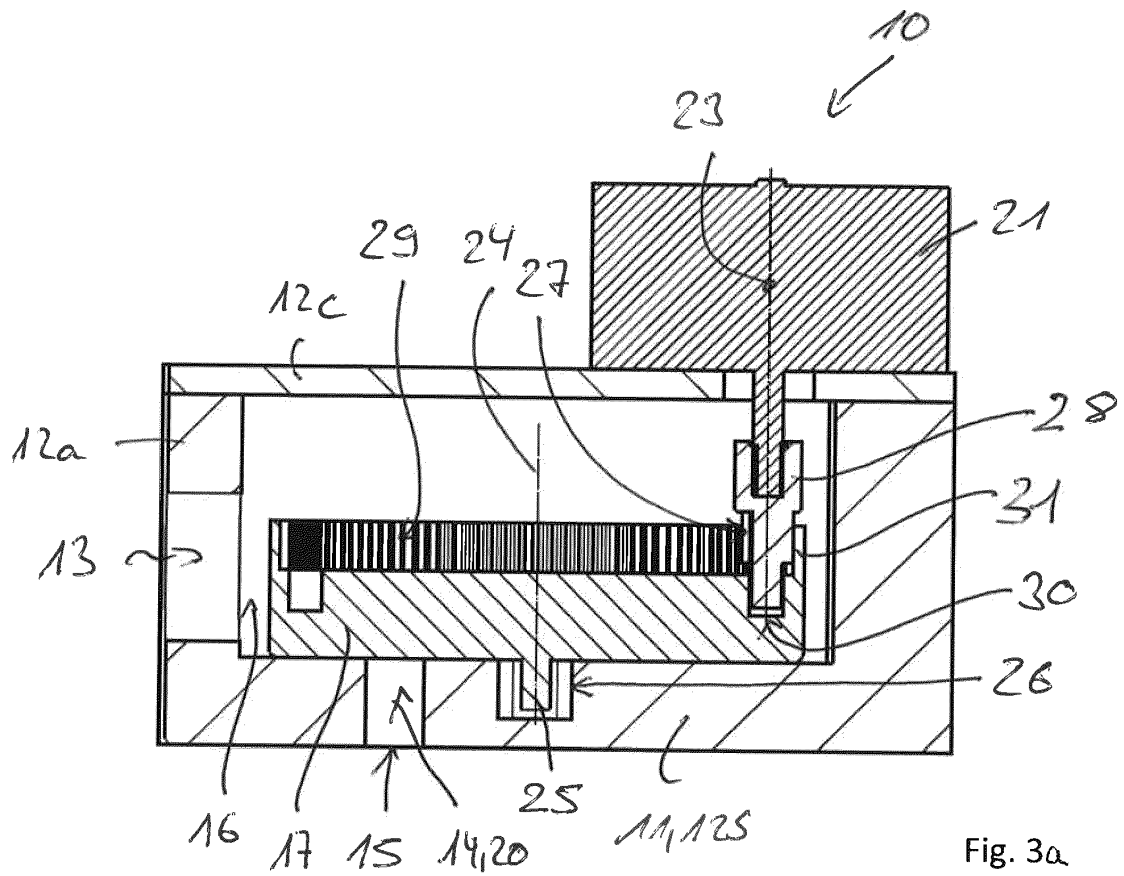
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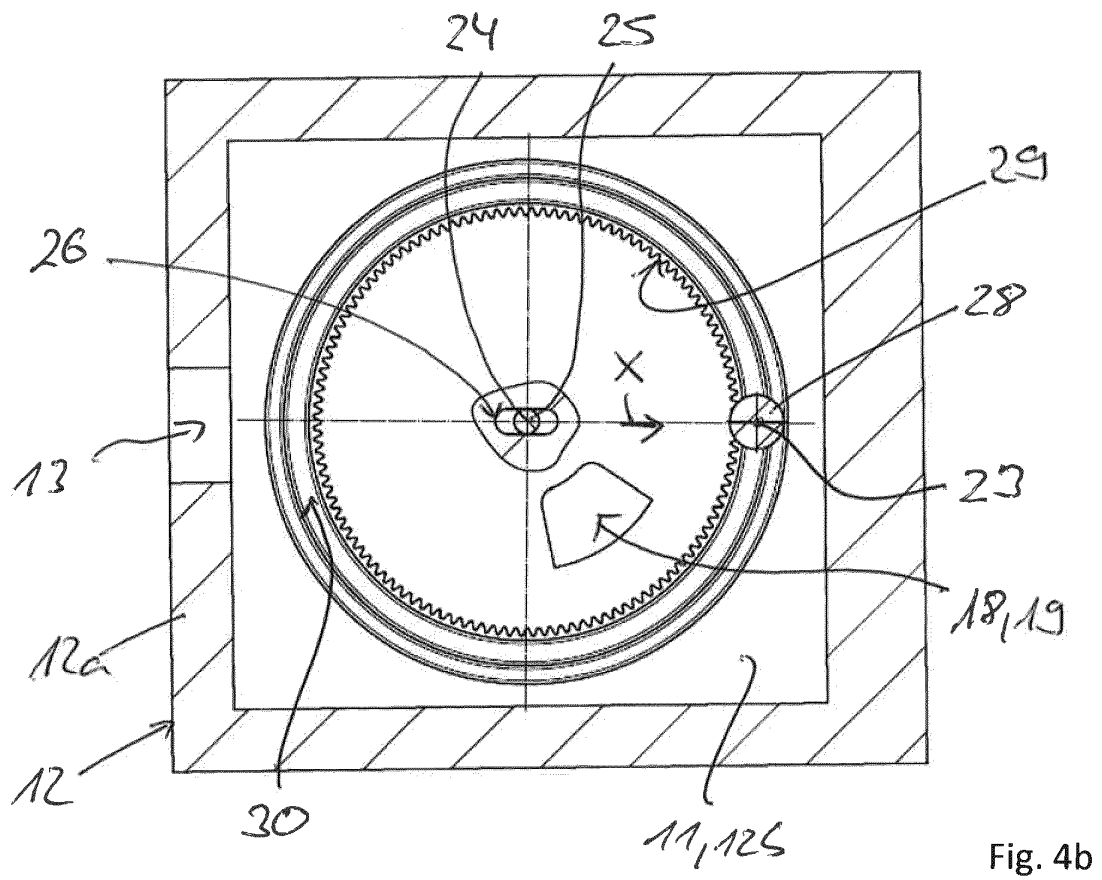
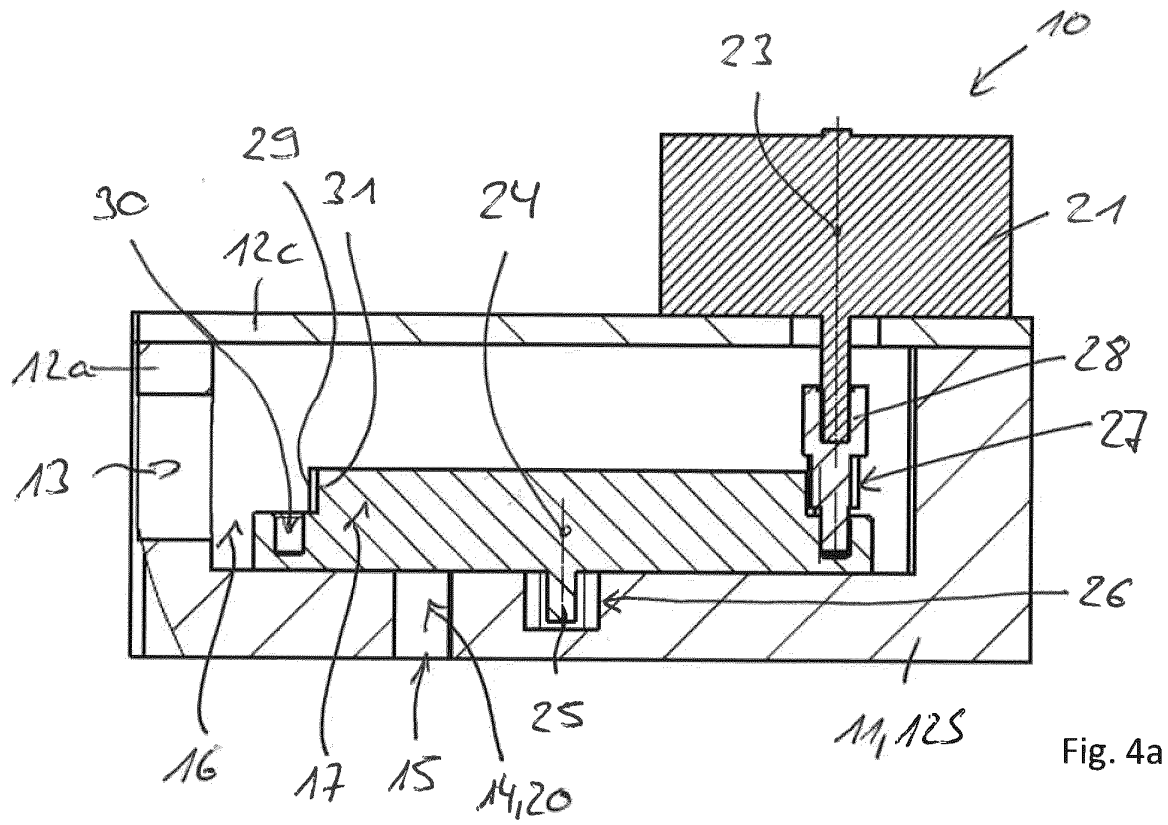
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REFERENCES CITED IN THE DESCRIPTION

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